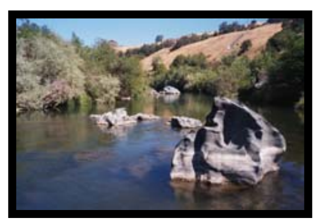
Upper Russian River
Steelhead Distribution Study



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UPPER RUSSIAN RIVER
STEELHEAD DISTRIBUTION STUDY

INTRODUCTION

The purpose of the Upper Russian River Steelhead Distribution Study is to evaluate the distribution of steelhead (*Oncorhynchus mykiss*) during summer conditions and assess habitat along the Russian River. Rearing habitat for steelhead may be limited in the river during summer when flows are lowest and water temperatures are highest. This study was a component of the Fisheries Enhancement Program (FEP) implemented by the Sonoma County Water Agency. The goal of the FEP is to improve native fish resources of the Russian River basin.

The distribution of rearing steelhead in the Russian River during the summer is affected by habitat conditions. Water quality is an important factor in the growth and survival of steelhead. Steelhead require streams with cold, clear water. Flow rates influence habitat features such as water temperature, flow velocities, and water depth. Russian River summer flows are supplemented by dam releases at Coyote Dam (Lake Mendocino) located on the East Fork of the Russian River near Ukiah and Warm Springs Dam (Lake Sonoma) located on Dry Creek west of Healdsburg.

In summer and fall 2001 a flow-related habitat study was conducted in collaboration with several entities, including U.S. Army Corps of Engineers, National Marine Fisheries Service, California Department of Fish and Game, North Coast Regional Water Quality Control Board, Sonoma County Water Agency, and Entrix. The study evaluated habitat value for steelhead along the Russian River and Dry Creek at a range of water release rates from Coyote and Warm Springs dams. Observations made during the flow study indicated that potential spawning and summer rearing habitat for steelhead was present in the upper main stem of the Russian River. The Steelhead Distribution Study was developed to further determine the extent of potential rearing habitat. The objectives of the study were to

- determine the summer distribution of steelhead and rearing habitat,
- compare the relative abundances of steelhead and habitats, and
- develop a photograph library of habitats along the Russian River.

The study area extended 106 km along the Russian River from Ukiah to Healdsburg. Dive surveys were conducted to count fish at randomly selected river segments. Also, habitat characteristics were recorded and photographs taken at all survey sites.

METHODS

Sampling Design

The survey design for the Steelhead Distribution Study was based on underwater visual observations of fish during dive (snorkel) surveys within selected segments of the Russian River. The study was conducted on the upper Russian River from the confluence of the East and West forks of the Russian River near Ukiah to the confluence with Dry Creek near Healdsburg. The river was divided into 4 reaches based on gradient and surrounding topography, including Ukiah, Canyon, Alexander Valley, and Healdsburg reaches. Between 5 and 12 sample segments of approximately 0.5 km in length were randomly selected within each reach. A total of 37 segments were sampled, which equals approximately 17.5% of the upper Russian River. Dive surveys were conducted in the summer from July 31 through September 19, 2002, typically a time of year when flows are at low levels and temperatures are relatively high.

The purpose of this study is to determine the relative abundance and distribution of steelhead, and is not intended to generate population estimates. Dive count surveys are most useful in determining the relative abundances of fish but are limited in determining the true fish population. Numerous factors, such as water clarity, water depth, water velocity, water temperature, fish size, fish behavior, and sampling methods will affect the ratio of the fish observed to the true population. Comparisons of fish counts between sites are appropriate only when the factors that cause variation are similar. Comparisons of fish counts were restricted to segments within reaches and combined segment data among reaches.

Habitat Assessment
River sample segments were classified into 4 habitat types: deep pool, flatwater, riffle, and cascade. These habitat categories were modified from California Department of Fish and Game habitat types (Flosi et al. 1998). Habitat descriptions are as follows:

> <u>Deep Pools</u>: Deep pools are characterized by areas of still or slow moving water with a highly pronounced scour channel or pocket. Deep pools were greater than two meters in depth.
>
> <u>Flatwater</u>: Flatwater is characterized by consistent water depths and even or gradually changing velocities of low to moderate speeds. Also, some shallow pools or lateral trenches were included in flatwater. Surface character ranged from smooth to choppy with few standing waves. Unlike riffles, flatwater generally lacked whitewater and extensive waves.
>
> <u>Riffles</u>: Riffles were habitats of increased gradient with considerable surface turbulence, much of which could be whitewater. Surface turbulence was typically maintained by irregular substrate, such as boulders or angular bedrock, or and abrupt change in gradient. Riffles were relatively shallow with an even depth profile.
>
> <u>Cascade:</u> Cascades are steep gradient, narrow streams with step-pools connected by small waterfalls and fast-moving shoots. Water turbulence is mostly whitewater. Because of the high-energy flows, the substrate is predominantly boulders and bedrock.

Habitat characteristics of each survey segment were recorded in the field. Segments were marked with flagging and delineated on aerial photographs. Habitat percent cover was visually approximated in the field with the aid of aerial photographs. Prominent habitat features (e.g., large woody debris, scour pools, undercut banks, overhanging vegetation) were noted and used to qualitatively describe habitats within segments. Bottom water temperatures were taken at each segment during the afternoon when daily temperatures are generally highest. Water temperatures were compared with permanent temperature stations located within reaches using weekly average and weekly maximum temperatures. Weekly average temperature is the 7-day average of the average daily temperature and weekly maximum is the 7-day average of the daily maximum temperatures. Also, each habitat unit was photographed and coordinates recorded using a global positioning system (GPS). A Photograph Library of river habitats and observed fish is included in the Appendix.

Visual Underwater Fish Counts

Crews of three biologists were used to conduct visual underwater dive surveys. Survey sites were accessed by walking along stream banks or by kayak. Kayaks were typically moored downstream of the sample segment. Each diver was equipped with a mask, snorkel, swim fins, and wetsuit (see Appendix for photographs of divers). Also, each diver was equipped with an arm cuff and pencil to tally fish.

The upper and lower boundaries and dive lanes of a segment were determined before divers entered the water. The segment was partitioned into parallel dive lanes running along the stream length. Partitioning reduced the possibility of duplicating or missing fish observations between divers and improved confidence in each diver's count. Typically, 2 divers would survey along the banks and 1 diver would survey the mid-stream lane. Segments having non-parallel streambanks were accommodated by constricting or expanding lane widths. In broad sections of the river were the mid-stream lane was disproportionately wide the diver would survey in an “S” pattern.

To conduct visual underwater surveys divers entered the water at the downstream boundary, moved to a lane, and proceeded upstream. Divers counted fish observed to pass downstream within their lanes and maintained visual contact with adjacent diver(s) to minimize multiple counting of the same fish. The ability to see underwater was monitored during dive counts by estimating water visibility at each dive site. Typically, minimum visibility was at least 1-2 m and often >3 m.

All fish observed during surveys were identified to species when feasible. The Appendix includes photographs of fish. Several minnow species have similar diagnostic features and can be difficult to identify when young. California roach (*Hesperoleucus symmetricus*), pikeminnow (Sacramento squawfish, *Ptychocheilus grandis*), carp (*Cyprinus carpio*), and hardhead (*Mylopharodon conocephalus*) are common fish in the minnow family (Cyprinidae) and were identified to family when species identity was not possible. Each diver recorded the number of observed fish and size class during the survey. At the end of a survey fish data from all divers were recorded on a data form for each segment.

Divers calibrated 3 fish size classes (i.e., <100 mm, 101-300 mm, and >300 mm) by viewing fish silhouettes prior to surveying a segment. Age analysis of steelhead scale annuli (i.e., scale growth rings) captured in the Russian River watershed indicated a direct correlation between fish size and age (Cook and Manning 2002). In general, steelhead size indicated that fish <100 mm in length correspond to young-of-the-year fish, fish 101-300 mm in length are >1 year old (i.e., 1+), and fish greater than 300 mm in length are >2 years old (i.e., 2+).

RESULTS AND DISCUSSION

Steelhead Distribution and Habitat

Steelhead were observed in all 4 study reaches; however, their distribution and numbers varied substantially (Figure 1). A total of 1,436 steelhead were observed in the 37 sample segments. Each segment was approximately 0.5 km in stream length. Steelhead were found in the upper portion of the Ukiah reach, throughout most the Canyon reach, and infrequently in the Alexander Valley and Healdsburg reaches. The fish composition of the study reaches included 12 native and non-native fish species. Steelhead composed <1% to 5% of the counted fish (Figure 2). The largest numbers of steelhead were observed in the Canyon reach at 265 steelhead/km followed by the Ukiah reach at 37 steelhead/km (Figure 3). The Alexander Valley and Healdsburg reaches had relatively few steelhead observations at <1 and 7 steelhead/km, respectively. Fish numbers were determined by visually counting fish during dive surveys and are not population estimates.

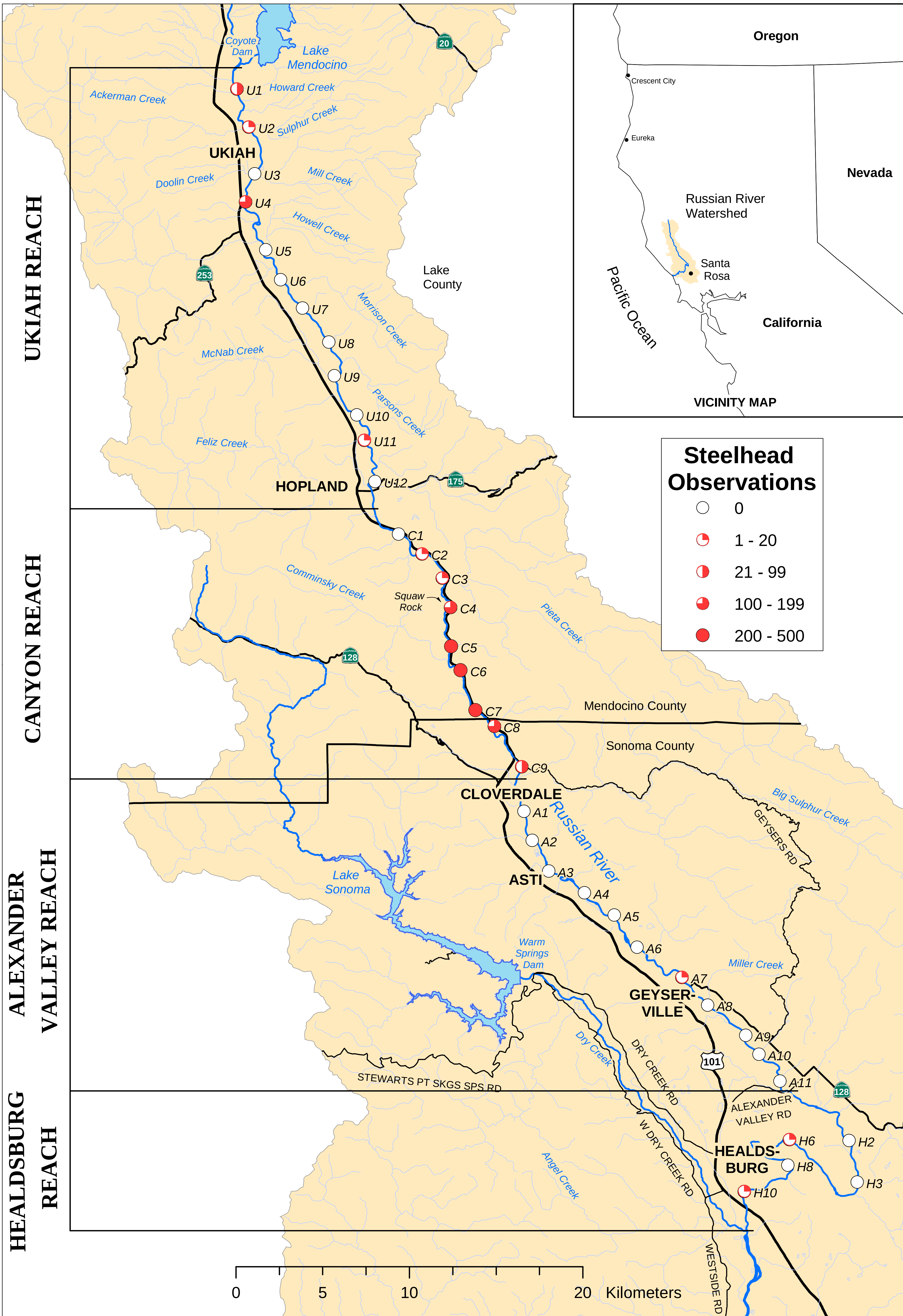
Most of the habitats within reaches were composed of flatwater with relatively low frequencies of cascade, riffle, and deep pool habitats (Figure 2). Also, the Appendix includes photographs that characterize the habitat with each reach. Dive observations indicated that steelhead were almost exclusively found in riffle and cascade habitats, and flatwater and deep pool habitats were seldom utilized. Riffle and cascade habitats occur in moderate to high gradient stream sections and were most frequently found in the Canyon reach with an average slope of 0.0026% (Figure 4). In comparison, the Ukiah, Alexander Valley, and Healdsburg reaches had average gradients approximately half of the Canyon reach and ranged from a slope of 0.0012% to 0.0014%.

Water Temperature

Water temperature can affect the growth rate and survival of steelhead. Exposure to short duration of high temperatures can cause mortality and long-term exposure to elevated temperatures can retard growth. Dive surveys were conducted in late summer when annual temperatures and potential stress on steelhead were highest. Sullivan et al. (2000) reviewed several studies mainly from Oregon and Washington on the affects of temperature on salmonids, including steelhead. In general, suitable temperatures for young steelhead in freshwater habitats range from 12°C to 20.5°C. Temperatures from 20.5°C to 23.5°C may result in behavioral changes (e.g., reduced activity and feeding) and restrict growth. Prolonged exposure to temperatures from 23.5°C to 26.5°C can cause mortality and temperatures above 26.5°C result in rapid death. However, the Russian River is located in the southern range of the species where regional temperatures are relatively high and the temperature tolerance of steelhead may be higher than northern populations. For example, juvenile steelhead in the Eel River, located north of the Russian River, have been observed feeding in surface waters with temperatures up to 24.0°C (Nielsen et al. 1994).

Maximum water temperatures of study reaches generally increased with distance downstream and had similar patterns in temperature fluctuations. Figure 5 shows the weekly maximum temperatures for the 4 reaches. Temperature trends among reaches showed a convergence over the duration of the study with in broader range of temperatures in mid-summer than observed in late summer.

Temperature data collected during dive surveys were comparable to permanent temperature stations located in the study reaches. In general, water temperatures at survey segments were



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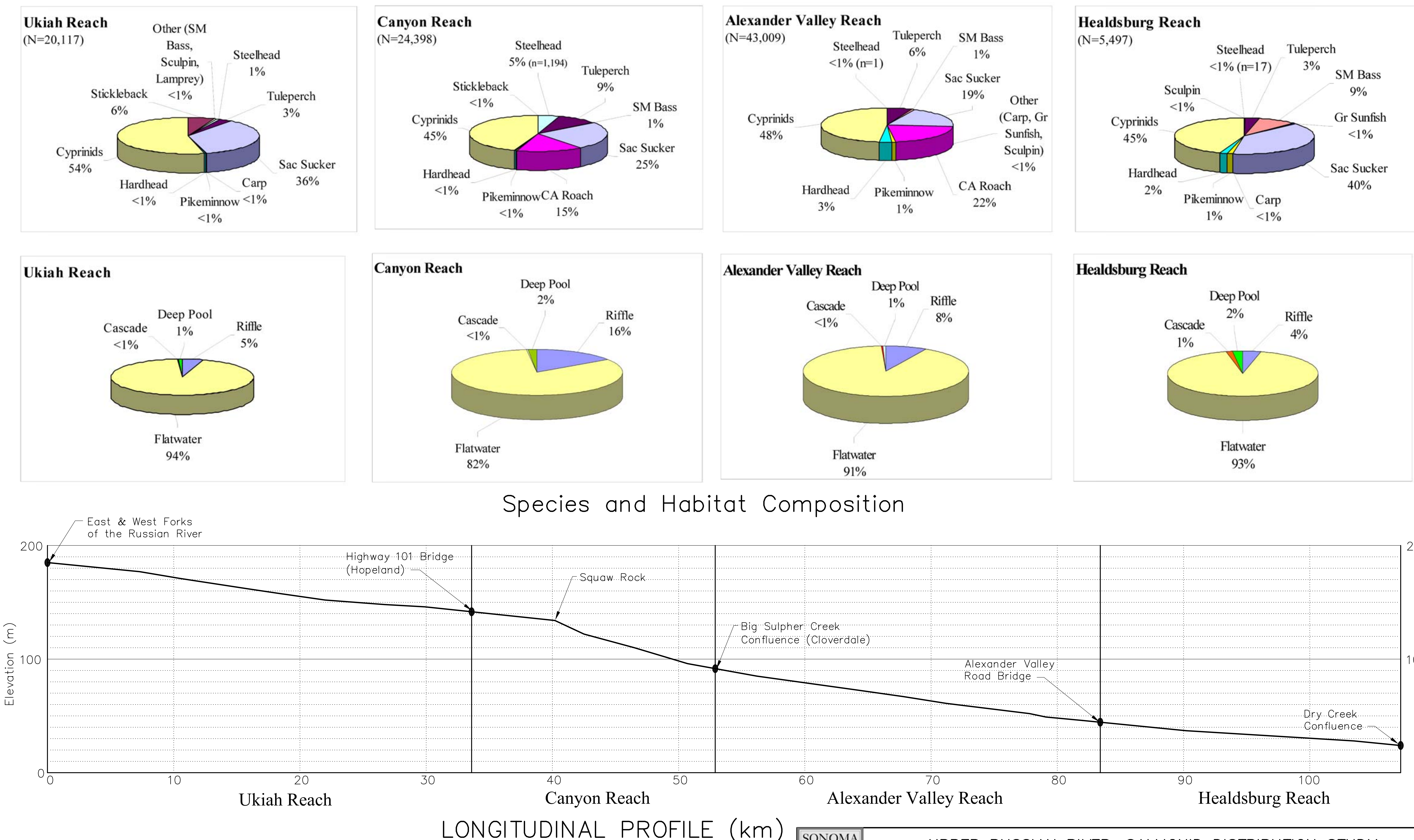
UPPER RUSSIAN RIVER: SALMON DISTRIBUTION STUDY

STEELHEAD DISTRIBUTION AND RELATIVE ABUNDANCE

Figure 1



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UPPER RUSSIAN RIVER, SALMONID DISTRIBUTION STUDY
SPECIES COMPOSITION AND HABITAT CHARACTERISTICS

FIGURE 2

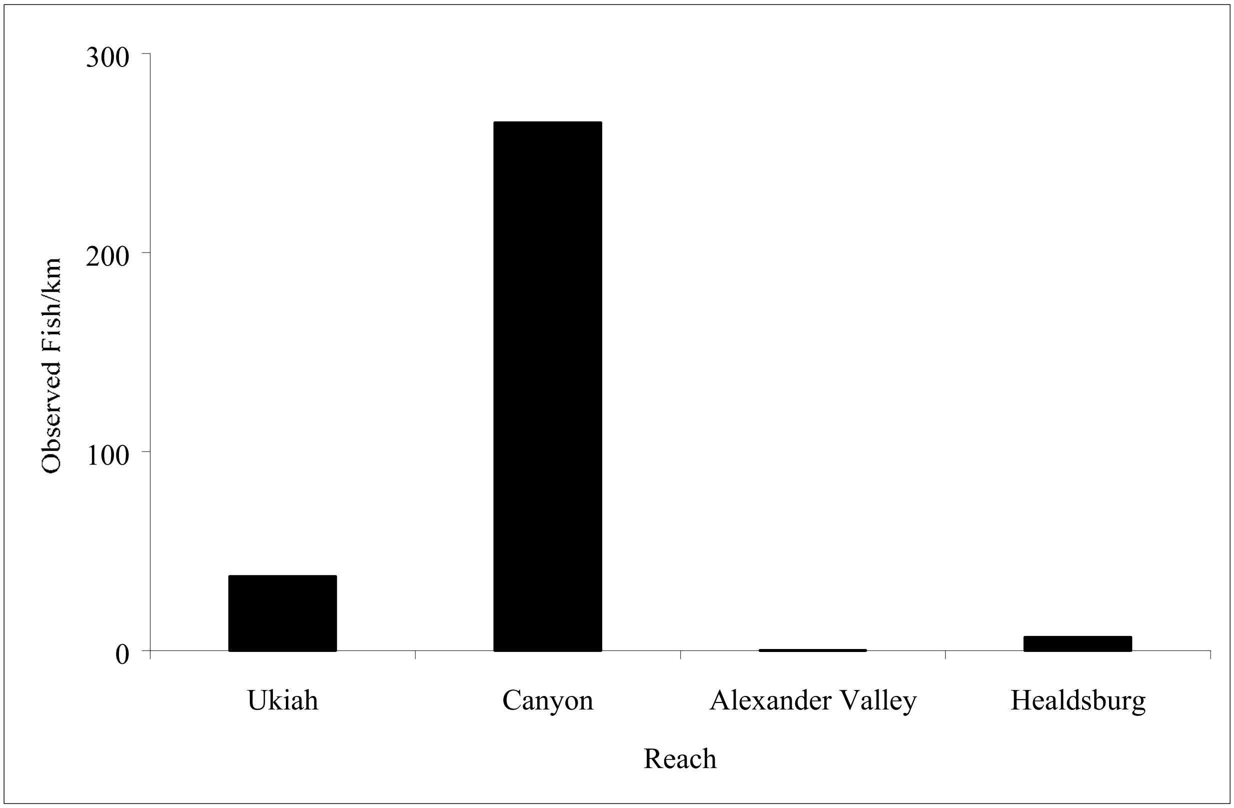

Figure 3: Steelhead observations by reach. Fish counts are based on visual dive surveys and are not population estimates.

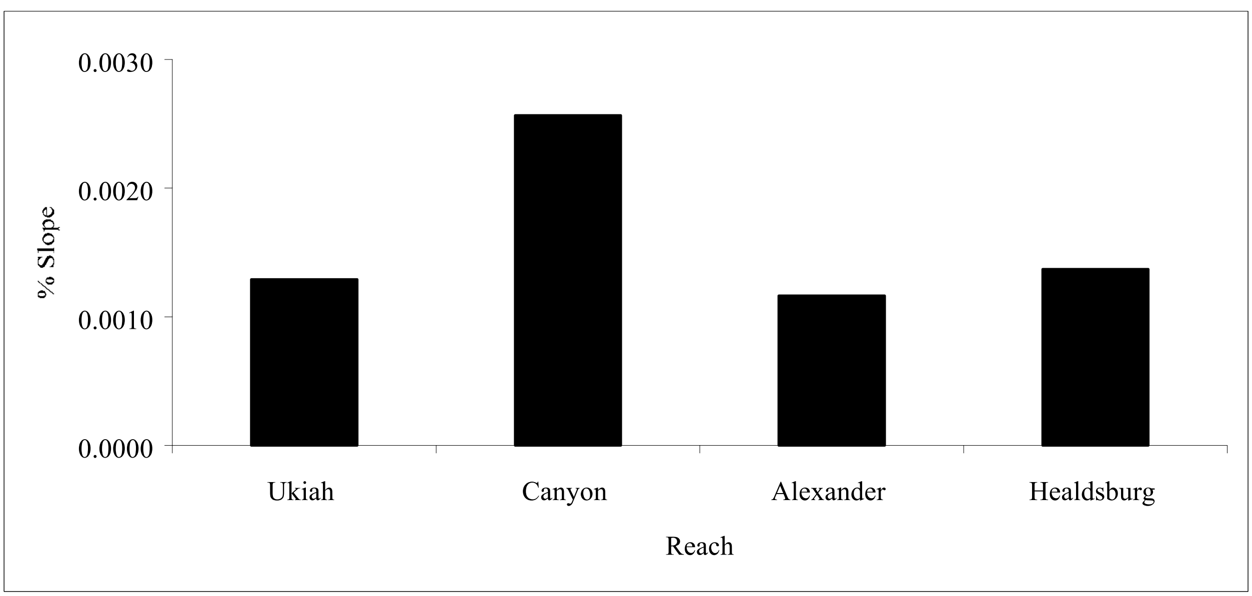

Figure 4: Average gradient by reach.

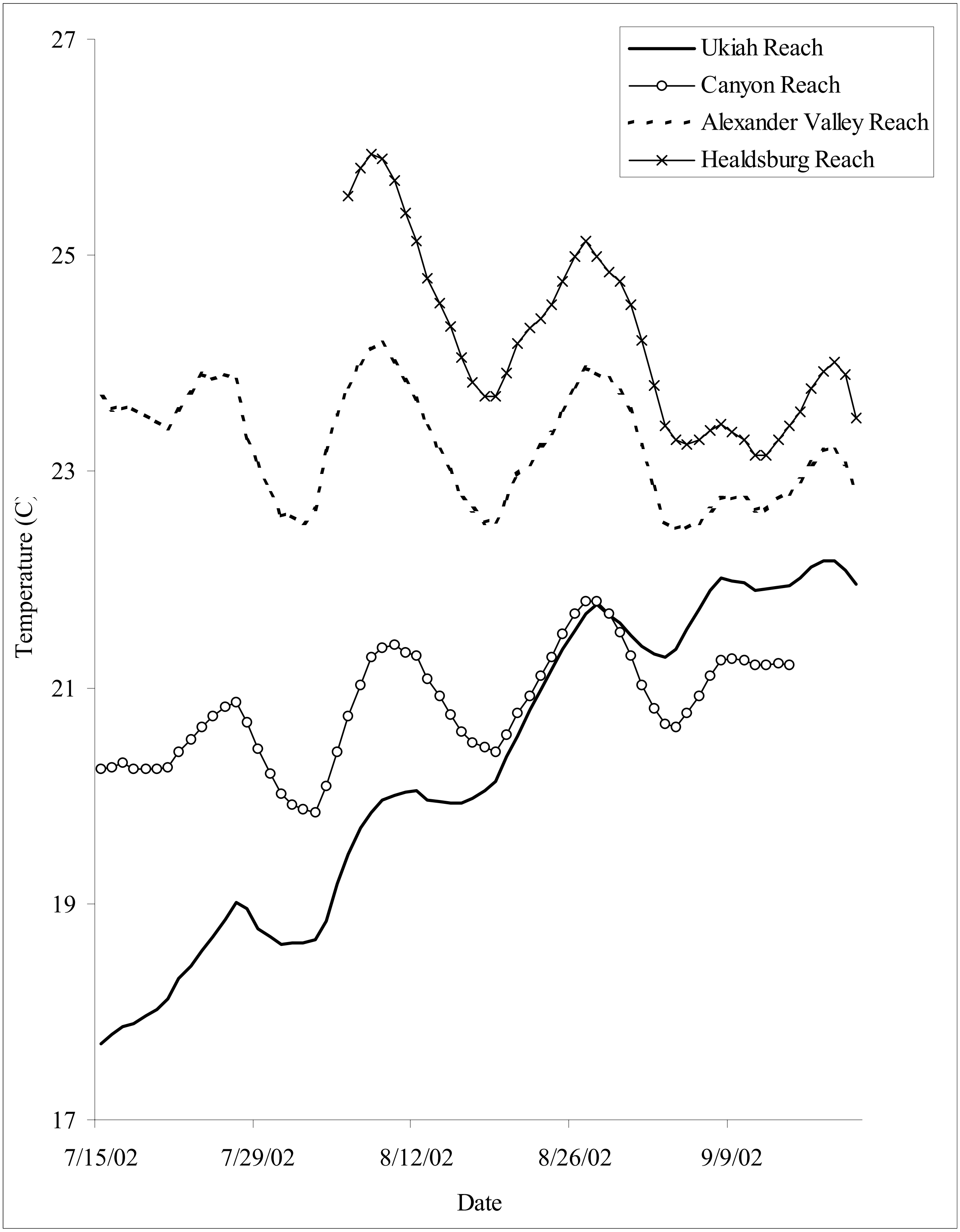

Figure 5: Weekly maximum water temperatures by reach. Temperature data collected at permanent stations.